



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:15 PM UTC

PDB ID : 8AW1 / pdb_00008aw1
Title : c-MET Y1235D mutant in complex with Tepotinib
Authors : Graedler, U.; Lammens, A.
Deposited on : 2022-08-29
Resolution : 2.14 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

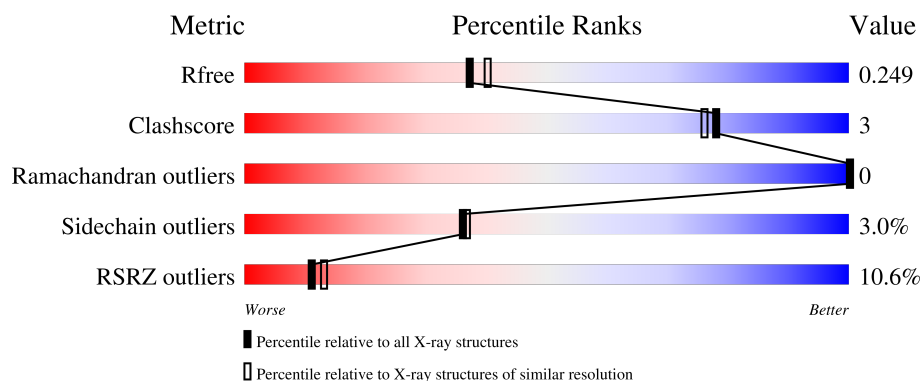
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.14 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	3689 (2.16-2.12)
Clashscore	190562	3812 (2.16-2.12)
Ramachandran outliers	187476	3773 (2.16-2.12)
Sidechain outliers	187428	3772 (2.16-2.12)
RSRZ outliers	180081	3691 (2.16-2.12)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	299	9% 79% 8% 12%
1	B	299	10% 81% 7% 12%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 4550 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

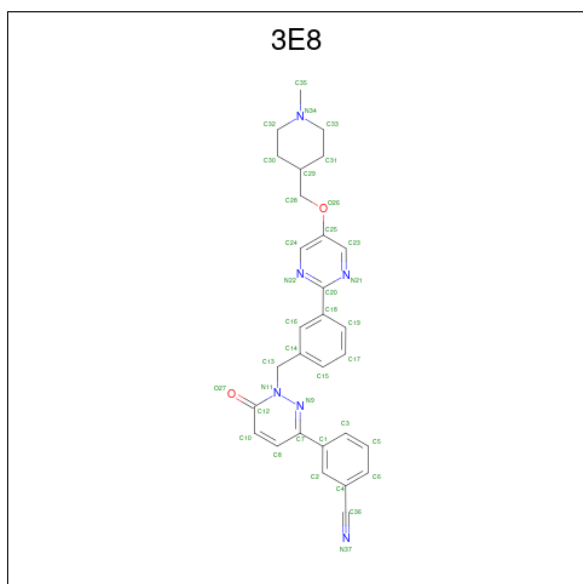
- Molecule 1 is a protein called Hepatocyte growth factor receptor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	263	Total	C	N	O	S	87	0	0
			2113	1370	358	370	15			
1	B	264	Total	C	N	O	S	77	1	0
			2126	1380	364	367	15			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1235	ASP	TYR	engineered mutation	UNP P08581
B	1235	ASP	TYR	engineered mutation	UNP P08581

- Molecule 2 is 3-[1-(3-{5-[(1-methylpiperidin-4-yl)methoxy]pyrimidin-2-yl}benzyl)-6-oxo-1,6-dihydropyridazin-3-yl]benzonitrile (CCD ID: 3E8) (formula: C₂₉H₂₈N₆O₂) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			37	29	6	2		
2	B	1	Total	C	N	O	0	0
			37	29	6	2		

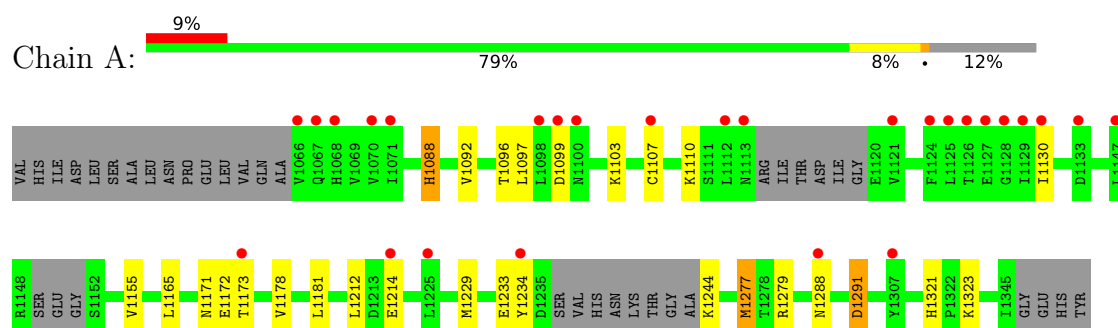
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	115	Total	O	0	0
			115	115		
3	B	122	Total	O	0	0
			122	122		

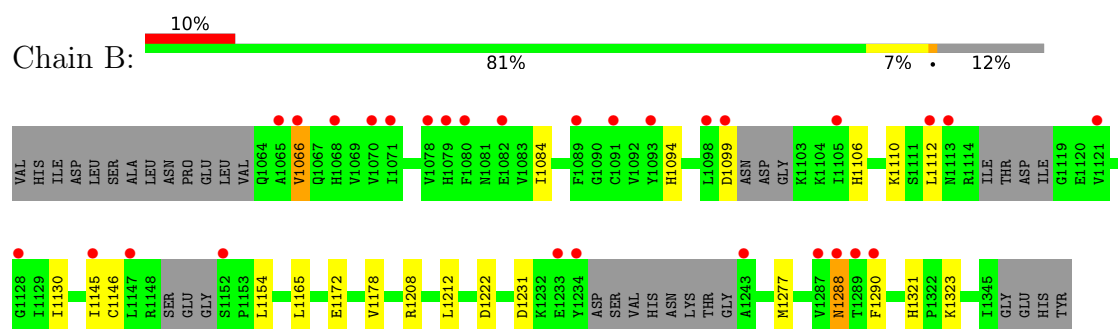
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Hepatocyte growth factor receptor



- Molecule 1: Hepatocyte growth factor receptor



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	77.83Å 43.29Å 89.29Å 90.00° 90.60° 90.00°	Depositor
Resolution (Å)	44.64 – 2.14 44.64 – 2.14	Depositor EDS
% Data completeness (in resolution range)	96.6 (44.64-2.14) 96.6 (44.64-2.14)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.10 (at 2.14Å)	Xtriage
Refinement program	BUSTER 2.11.8 (8-JUN-2022)	Depositor
R, R_{free}	0.217 , 0.241 0.212 , 0.249	Depositor DCC
R_{free} test set	1564 reflections (4.85%)	wwPDB-VP
Wilson B-factor (Å ²)	37.4	Xtriage
Anisotropy	0.096	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 52.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.028 for h,-k,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4550	wwPDB-VP
Average B, all atoms (Å ²)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 24.82 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 3.5647e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 3E8

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.73	1/2165 (0.0%)	1.02	2/2926 (0.1%)
1	B	0.70	0/2181	1.02	3/2945 (0.1%)
All	All	0.72	1/4346 (0.0%)	1.02	5/5871 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1277	MET	SD-CE	-5.19	1.66	1.79

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1171	ASN	CA-CB-CG	7.82	120.42	112.60
1	B	1130	ILE	CA-C-N	5.92	128.48	120.38
1	B	1130	ILE	C-N-CA	5.92	128.48	120.38
1	A	1291	ASP	CA-CB-CG	5.25	117.85	112.60
1	B	1112	LEU	N-CA-C	-5.24	102.36	109.54

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2113	0	2134	10	0
1	B	2126	0	2157	13	0
2	A	37	0	28	0	0
2	B	37	0	28	0	0
3	A	115	0	0	0	0
3	B	122	0	0	0	0
All	All	4550	0	4347	23	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (23) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1321:HIS:HD2	1:A:1323:LYS:H	1.37	0.73
1:B:1321:HIS:HD2	1:B:1323:LYS:H	1.38	0.71
1:A:1099:ASP:HB3	1:A:1103:LYS:HG2	1.83	0.59
1:A:1178:VAL:HG13	1:A:1277:MET:HE1	1.85	0.58
1:B:1178:VAL:HG13	1:B:1277:MET:HE1	1.86	0.57
1:B:1165:LEU:HD13	1:B:1212:LEU:HD11	1.87	0.57
1:A:1165:LEU:HD13	1:A:1212:LEU:HD11	1.87	0.56
1:B:1145:ILE:O	1:B:1145:ILE:HG13	2.10	0.52
1:A:1181:LEU:HD11	1:A:1279:ARG:HE	1.76	0.51
1:A:1088:HIS:ND1	1:A:1229:MET:HE3	2.27	0.50
1:B:1084:ILE:HG21	1:B:1094:HIS:CD2	2.47	0.49
1:B:1084:ILE:CG2	1:B:1094:HIS:CD2	2.97	0.47
1:A:1092:VAL:HG22	1:A:1110:LYS:HD2	1.98	0.46
1:B:1084:ILE:HG21	1:B:1094:HIS:NE2	2.31	0.46
1:A:1110:LYS:HB3	1:A:1155:VAL:HB	1.99	0.44
1:A:1097:LEU:HB2	1:A:1107:CYS:SG	2.58	0.43
1:B:1094:HIS:HD1	1:B:1106:HIS:CE1	2.34	0.43
1:B:1066:VAL:HG13	1:B:1145:ILE:HD11	1.99	0.43
1:B:1288:ASN:HD22	1:B:1290:PHE:H	1.66	0.42
1:B:1146:CYS:HB3	1:B:1154:LEU:HB2	2.02	0.41
1:A:1234:TYR:HB3	1:A:1244:LYS:HB3	2.02	0.41
1:B:1208:ARG:HD2	1:B:1231:ASP:HB2	2.02	0.41
1:B:1222:ASP:O	1:B:1222:ASP:CG	2.64	0.41

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	255/299 (85%)	251 (98%)	4 (2%)	0	100	100
1	B	255/299 (85%)	250 (98%)	5 (2%)	0	100	100
All	All	510/598 (85%)	501 (98%)	9 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	236/265 (89%)	227 (96%)	9 (4%)	29	28
1	B	236/265 (89%)	231 (98%)	5 (2%)	47	51
All	All	472/530 (89%)	458 (97%)	14 (3%)	36	37

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1088	HIS
1	A	1096	THR
1	A	1130	ILE
1	A	1172	GLU
1	A	1173	THR
1	A	1214	GLU
1	A	1233	GLU
1	A	1288	ASN

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Mol	Chain	Res	Type
1	A	1291	ASP
1	B	1066	VAL
1	B	1099	ASP
1	B	1110	LYS
1	B	1172	GLU
1	B	1288	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1079	HIS
1	A	1162	HIS
1	A	1256	GLN
1	A	1321	HIS
1	B	1088	HIS
1	B	1256	GLN
1	B	1288	ASN
1	B	1321	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

2 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond

length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	3E8	B	1401	-	41,41,41	0.78	1 (2%)	55,56,56	1.54	10 (18%)
2	3E8	A	1401	-	41,41,41	0.88	1 (2%)	55,56,56	1.52	10 (18%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	3E8	B	1401	-	-	0/19/29/29	0/5/5/5
2	3E8	A	1401	-	-	0/19/29/29	0/5/5/5

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1401	3E8	N11-N9	-3.40	1.29	1.37
2	B	1401	3E8	N11-N9	-2.89	1.30	1.37

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1401	3E8	C14-C13-N11	-4.07	106.46	112.76
2	B	1401	3E8	C7-N9-N11	3.78	123.01	118.14
2	B	1401	3E8	C14-C13-N11	-3.71	107.02	112.76
2	A	1401	3E8	C7-N9-N11	3.69	122.91	118.14
2	B	1401	3E8	C23-N21-C20	3.55	121.27	116.31
2	B	1401	3E8	C33-N34-C32	3.34	114.86	109.54
2	B	1401	3E8	C25-C23-N21	-3.17	118.76	122.67
2	A	1401	3E8	C23-N21-C20	3.05	120.57	116.31
2	A	1401	3E8	C12-N11-N9	-2.97	120.90	125.62
2	A	1401	3E8	C24-C25-C23	2.94	118.50	116.59
2	A	1401	3E8	C25-C23-N21	-2.75	119.27	122.67
2	B	1401	3E8	C12-N11-N9	-2.73	121.28	125.62
2	A	1401	3E8	C8-C10-C12	-2.70	117.27	121.69
2	A	1401	3E8	C24-N22-C20	2.67	120.04	116.31
2	A	1401	3E8	C25-C24-N22	-2.67	119.37	122.67
2	A	1401	3E8	C10-C12-N11	2.47	120.17	114.29
2	B	1401	3E8	C8-C10-C12	-2.36	117.82	121.69

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1401	3E8	C24-C25-C23	2.25	118.05	116.59
2	B	1401	3E8	C35-N34-C32	-2.14	106.56	110.63
2	B	1401	3E8	C10-C12-N11	2.10	119.30	114.29

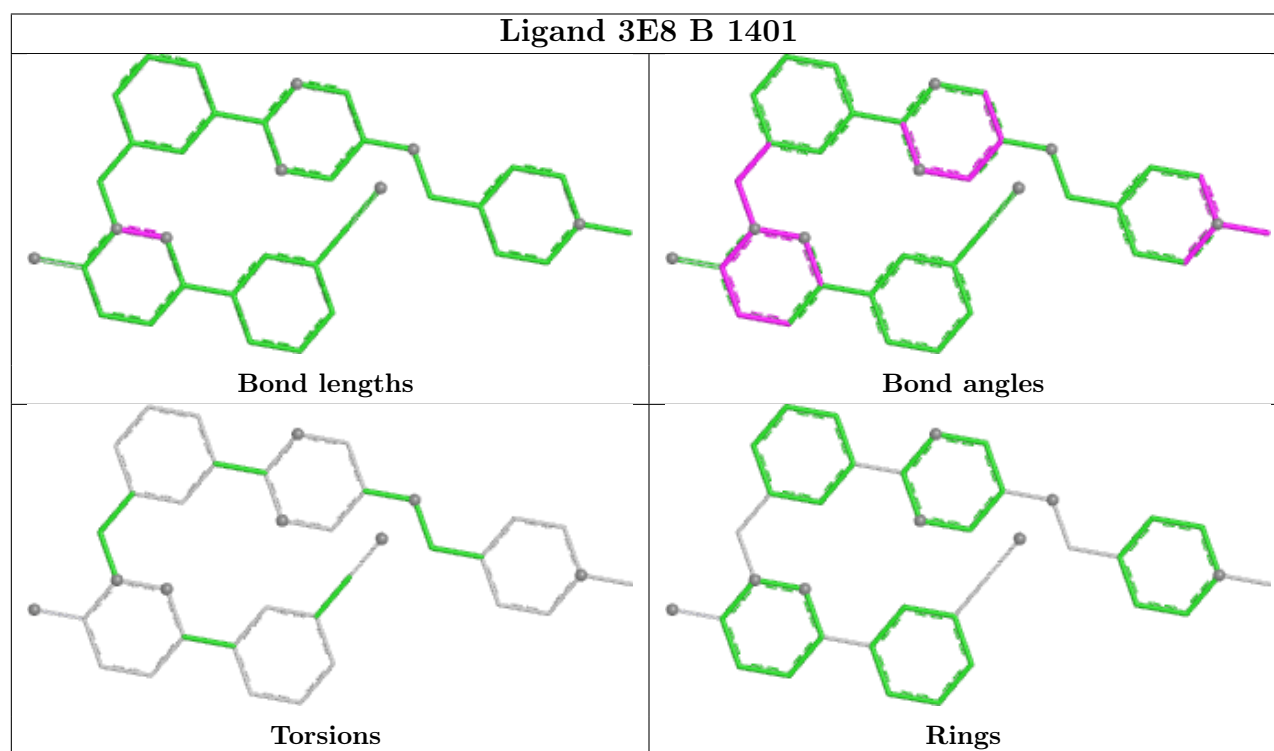
There are no chirality outliers.

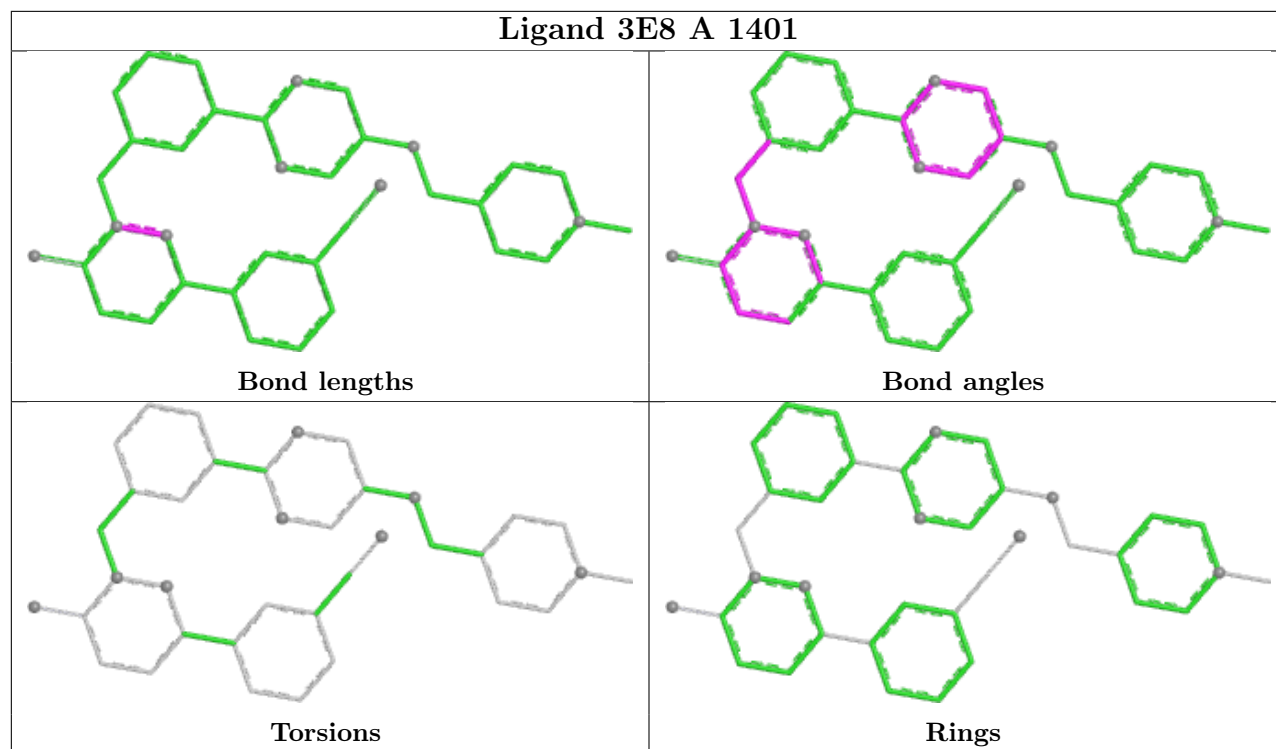
There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2		OWAB(Å ²)	Q<0.9
1	A	263/299 (87%)	0.61	27 (10%)	12 14	23, 39, 72, 96	22 (8%)
1	B	264/299 (88%)	0.67	29 (10%)	10 12	20, 40, 76, 93	23 (8%)
All	All	527/598 (88%)	0.64	56 (10%)	11 13	20, 39, 75, 96	45 (8%)

All (56) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	1234	TYR	3.9
1	B	1112	LEU	3.8
1	B	1066	VAL	3.8
1	B	1065	ALA	3.6
1	A	1066	VAL	3.5
1	A	1129	ILE	3.5
1	B	1152	SER	3.4
1	A	1071	ILE	3.2
1	A	1112	LEU	3.1
1	A	1125	LEU	3.1
1	A	1234	TYR	3.1
1	A	1127	GLU	3.0
1	A	1173	THR	2.9
1	A	1225	LEU	2.9
1	B	1098	LEU	2.9
1	A	1121	VAL	2.9
1	A	1100	ASN	2.9
1	A	1288	ASN	2.8
1	B	1243	ALA	2.8
1	A	1126	THR	2.8
1	B	1071	ILE	2.8
1	A	1214	GLU	2.8
1	A	1124	PHE	2.7
1	B	1147	LEU	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	1147	LEU	2.7
1	B	1068	HIS	2.7
1	B	1233	GLU	2.7
1	B	1289	THR	2.6
1	A	1133	ASP	2.6
1	A	1307	TYR	2.6
1	B	1070	VAL	2.5
1	B	1099	ASP	2.5
1	B	1145	ILE	2.5
1	A	1070	VAL	2.4
1	A	1067	GLN	2.4
1	A	1098	LEU	2.3
1	B	1078	VAL	2.3
1	B	1287	VAL	2.3
1	A	1099	ASP	2.3
1	B	1080	PHE	2.3
1	A	1068	HIS	2.3
1	B	1105	ILE	2.3
1	A	1107	CYS	2.3
1	A	1113	ASN	2.2
1	B	1091	CYS	2.2
1	A	1128	GLY	2.2
1	B	1093	TYR	2.2
1	B	1288	ASN	2.2
1	B	1113	ASN	2.2
1	B	1082	GLU	2.1
1	B	1128	GLY	2.1
1	A	1130	ILE	2.1
1	B	1290	PHE	2.1
1	B	1079	HIS	2.0
1	B	1089	PHE	2.0
1	B	1121	VAL	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

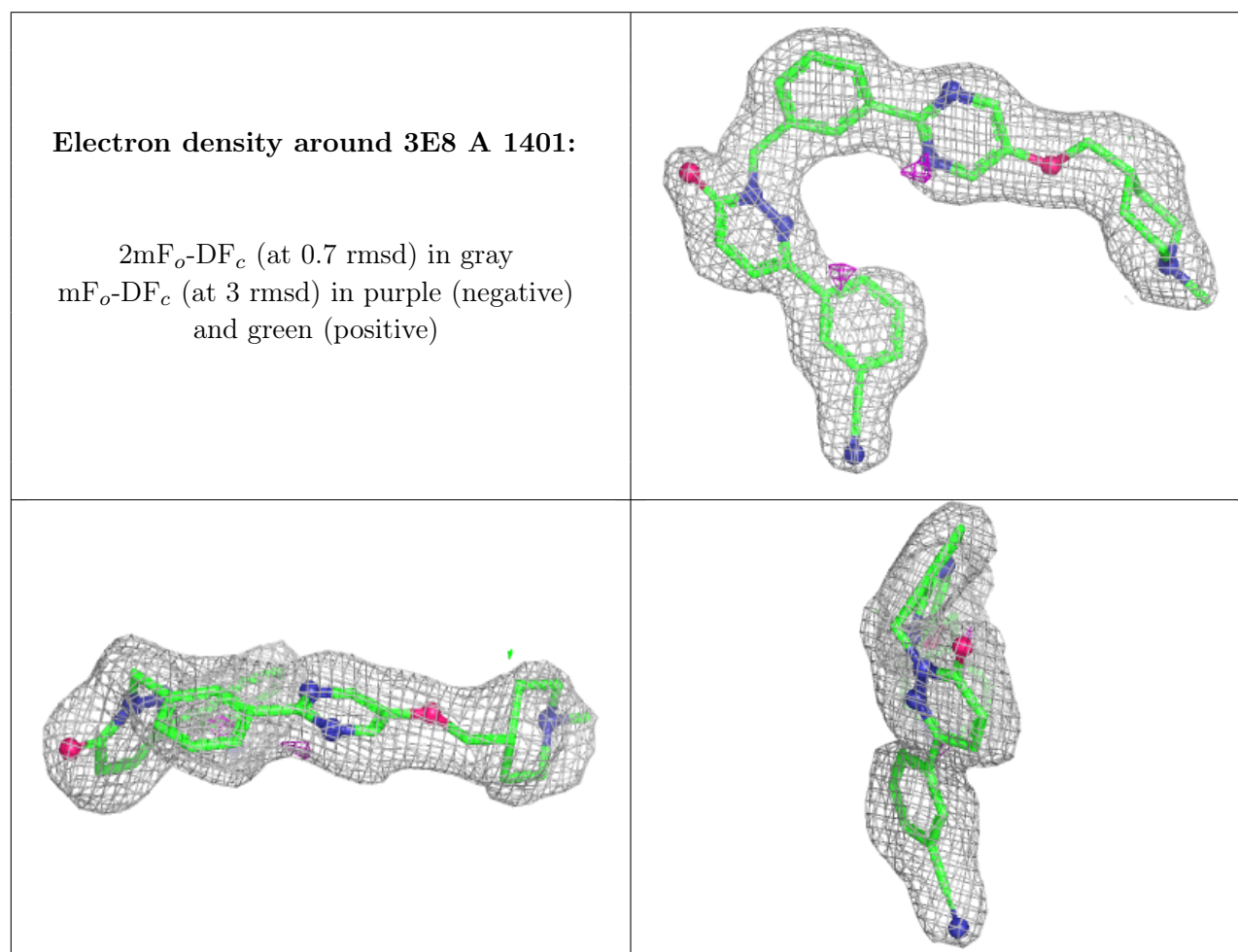
There are no oligosaccharides in this entry.

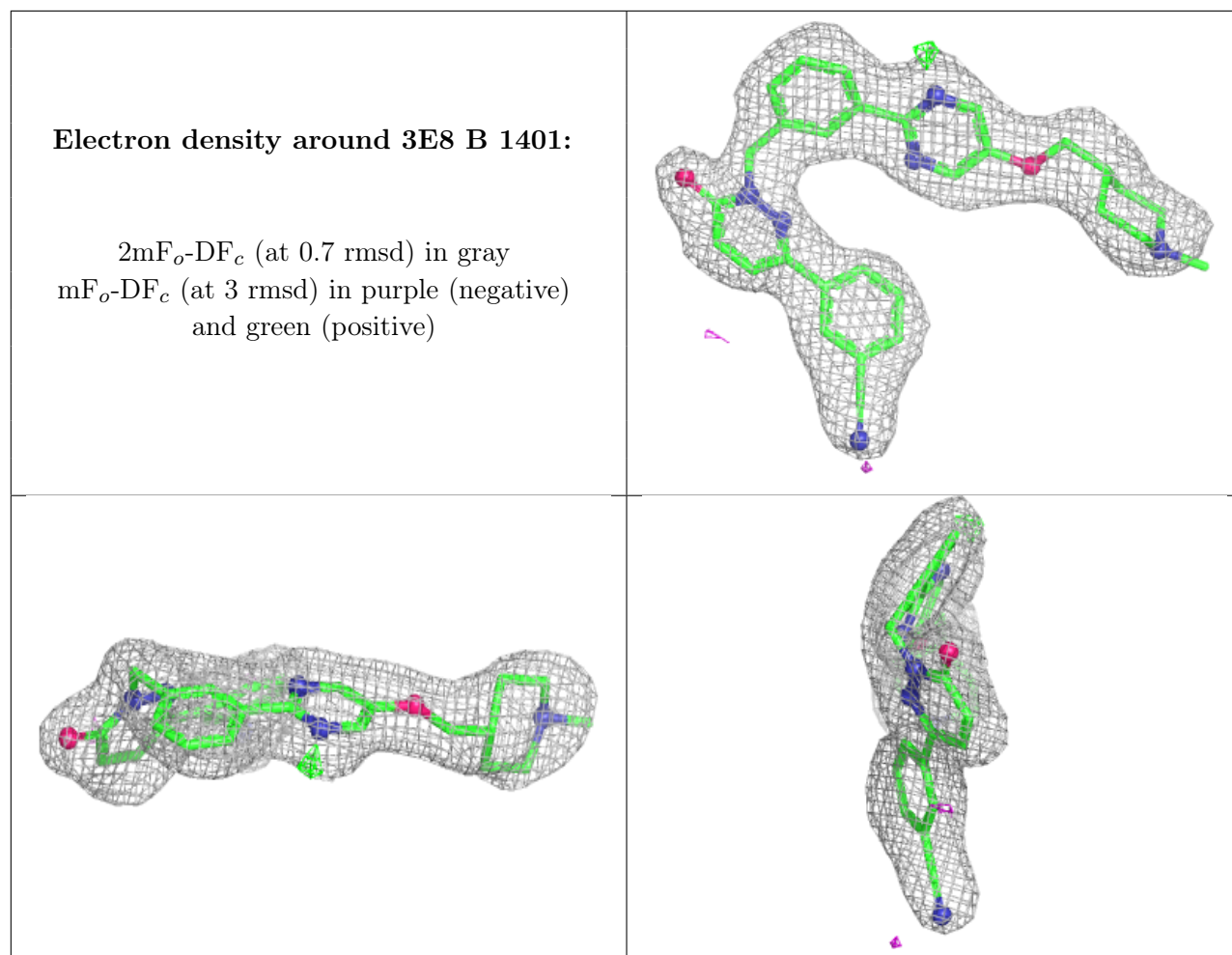
6.4 Ligands ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	3E8	A	1401	37/37	0.91	0.09	35,38,45,46	0
2	3E8	B	1401	37/37	0.93	0.09	33,37,46,48	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.





6.5 Other polymers [i](#)

There are no such residues in this entry.